which forces them to turn, horizontally, the gases lose their vertical velocity.

Applying this formula to the case in hand, it is found that the depth h_t will be 1.27 m or 4.17 ft. The horizontal velocity of the gases flowing out at the end of this arch, will be about 15.25 ft per second and their mean velocity will be about 10.20 ft per second. As soon as they pass beyond the end of the arch the hot gases "will have an ascensional component, due to their density, of zero at the end of the arch but increasing so that their rise "will be on an arc of a parabola unless interfered with by other forces. In the boiler setting these other forces are a current of colder gases descending among the tubes and the tubes themselves, and while a portion of the gases flowing out from under the arch will penetrate the colder layer of gases and possibly reach the baffle behind the tubes, this action will occur intermittently according as the current of hot or cold gas is stronger in its surges. Naturally these sudden changes in. the temperature of the gases at the baffle "will cause cracks and ultimately failure of the baffle as shown in Mr. Smith's article. When this occurs the hot gases will pass through the break as indicated in. Fig. 169.

At 226 Ib pressure absolute, the steam temperature is 200° C. The temperature of the outside of the iron tube should not exceed 220°, allowing a liberal drop between the "wet surface and the emulsion of steam and water, and assuming that the tube is clean, and free from both scale and soot. The temperature in the firebox is around 1400° C., and it has "been customary to assume that the curve representing the drop in temperature from the fire to the smoke-flue outlet is a regular logarithmic curve, this curve being based upon assumptions which violate the simplest

principles of elementary physics. The difference of 1200° between the hot gases and the water tube is nearly five times the difference in temperature between that of the workroom and the temperature of liquid hydrogen, —259°. The refrigerating effect of the cold tube on the hot gases is almost equivalent to that of dipping a red-hot bar of steel into liquid hydrogen. The ignition temperature of the gases varies between 350° and 800°; any portion of the unburned gases coming in close contact with the tubes will be chilled belo^y the ignition point. In the case of CO this may